

WHAT IS CLAIMED IS:

1. A diffractive optical element comprising

- a polycrystalline substrate and

- an upper film layer which is laminated on the substrate, wherein the
5 material of the upper film layer

is the same material as the substrate, and having finer crystal grains
compared with crystal grains of

the substrate or having an amorphous structure, and

- the upper film layer is dry etched.

10 2. A diffractive optical element according to claim 1, further comprising a
buffer layer provided between the substrate and the upper film layer.

3. A diffractive optical element according to in claim 2, wherein the buffer
layer is selected from the materials having an optical absorption coefficient
of not more than 10 cm^{-1} at the operating wavelength.

15 4. A diffractive optical element according to claim 1, wherein the substrate is
made of ZnSe.

5. A diffractive optical element according to claim 2, wherein the substrate is
made of ZnSe.

6. A diffractive optical element according to claim 3, wherein the substrate is
20 made of ZnSe.

7. A diffractive optical element according to claim 4, wherein the substrate is
formed by a chemical vapor deposition method.

8. A diffractive optical element according to claim 2, wherein the buffer layer is

made of a fluorine compound.

9. A diffractive optical element according to claim 2, wherein the upper film layer and the buffer layer are formed by a vapor phase growth method.

10. A diffractive optical element according to claim 2, wherein the upper film 5 layer and the buffer layer are formed by a vapor deposition method.

11. A diffractive optical element according to claim 1, wherein the dry etching is performed by a reactive ion etching method.

12. A diffractive optical element comprising

- a ZnSe polycrystalline substrate formed by a chemical vapor deposition 10 method and

- an upper film layer which is formed by a vapor deposition method on the substrate, wherein the

material of the upper film layer is the same material of the substrate, and having finer crystal grains

15 compared with crystal grains of the substrate or having an amorphous structure, and

- the upper film layer is dry etched by a reactive ion etching method.

13. A diffractive optical element according to claim 12, further comprising a buffer layer made of a fluorine compound having been formed by a vapor 20 deposition method.

14. A diffractive optical element for carbon dioxide gas laser comprising a substrate having polycrystals whose crystal grain size is not more than about 1 μm , or having an amorphous phase at the dry-etched surface

thereof.